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NOTES ON GEOGRAPHIC DISTRIBUTION

Bryozoa, Cheilostomata: First records of two invasive species in Australia and the northerly range extension for a third

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ABSTRACT: Biofouling of international marine vessels is one of the most important mechanisms for the transfer of non-native-invasive species around the world. Bryozoan species are some of the commonest of these marine biofouling organisms found worldwide. Whilst some efforts have been made to document the bryozoan species in Australian ports, these surveys are very limited in number, poorly resolved and lack repetition. This paper records two invasive bryozoan species new to Australian waters (*Hippoporina indica* and *Biflustra grandicella*), and a northerly range extension of a known invasive bryozoan (*Zoobotryon verticillatum*).

Bryozoans are a phylum of sessile, colonial suspension-feeders found throughout the world in both marine and freshwater environments. Bryozoan species are some of the commonest marine fouling organisms found worldwide, yet their distribution is not well known, generally through a lack of interest in the group and the perception that their taxonomy is difficult. The bryozoan fauna of the Queensland coast and the Great Barrier Reef (GBR) in particular, is probably one of the richest and most taxonomically diverse in the world (estimated at 1000 species; Tilbrook, unpub. data). Bryozoans are a significant and ecologically important component of coral reef ecosystems, aiding their structural integrity (Cuffey 1972) and providing food for many fishes and molluscs (Lidgard 2008); but the GBR is threatened by the effects of human activity and global warming. Although the introduction of invasive species in itself may not have a direct detrimental effect on the native fauna (Gurevitch and Padilla 2004), the fact that these introductions are possible, and that other bryozoan species can extend their range, is indicative of issues of deeper and greater concern. With the increase in transoceanic traffic and thus the movement of several species to whole communities (e.g. Wanless *et al*. 2010) at one time is of great concern and highlights the need for more baseline studies and risk assessments for the possible introduction of non-native species to Australian waters. The need for the correct species-level taxonomic determination of fouling bryozoans has been highlighted previously (Tompsett *et al.* 2009).

As a result of some preliminary investigations into the bryozoan faunas of Queensland's marinas, two invasive species have been found, *Hippoporina indica* Pillai, 1978 and *Biflustra grandicella* (Canu and Bassler, 1929); this is the first record of either from Australian waters.

Hippoporina indica (Figures 1–3: Cheilostomata; Bitectiporidae) was first described from Mumbai, India and has subsequently been recorded from Hong Kong (Liu and Li 1987), the Chinese Seas (Liu *et al.* 2001), New Zealand (Gordon *et al.* 2008), the Gulf of Mexico, and the Atlantic coast of the USA (McCann *et al*. 2007). In Australia, *Hippoporina indica* was first noticed in Manly Harbour Marina, Brisbane (27°27'20" S; 153°11'24" E) in March 2010 on settlement plates attached to pontoons, and marina pylons; it was noted as very common that austral summer-autumn (Dustin Marshall pers. comm. 2011). In Brisbane its peak growing period is between February and May when it can occupy up to 30% of bare substrate space; however, this can drop to less than 3% cover outside of these months. McCann *et al*. (2007) described the known ecology of this species. It is worth noting that in Brisbane colonies underwent a salinity crisis during the massive flooding event of January 2011 – colonies surviving a minimum salinity of 10 ppt (Dustin Marshall pers. comm. 2011). In Townsville, some 1500 km north of Brisbane, the author found brooding colonies of *H. indica* at Townsville Motor Boat and Yacht Club marina (TMBYC marina) (19°15' 31"S; 146°49' 21"E) on the Ross Creek in early June 2011; weeks after the Brisbane population had significantly shrunk in size. The peak period of growth for *H. indica* in Townsville thus seems to lag behind that of the Brisbane population by several weeks and is several months behind the populations in India and Chinese waters (Pillai 1978; Liu *et al*. 2001). The exact timing of peak growth and reproduction for *H. indica* in Townsville is currently being monitored.

Biflustra grandicella (Figures 4 and 5: Cheilostomata; Membraniporidae) was originally described from the "China Sea, in the vicinity of Hong Kong" (Canu and Bassler 1929), thus it is endemic to southern Chinese waters where it is one of the commonest fouling bryozoans (Liu 1992). However, in 2003 *B. grandicella* was recorded from Golden Bay, New Zealand (west coast, South Island: 40°46'10" S; 172°°52'00" E) (Grange and Gordon 2005). The specimens were collected by scallop dredges. Colonies were in the size range 100 x 70 mm to 400 x 300 mm; it is not known whether these represented complete

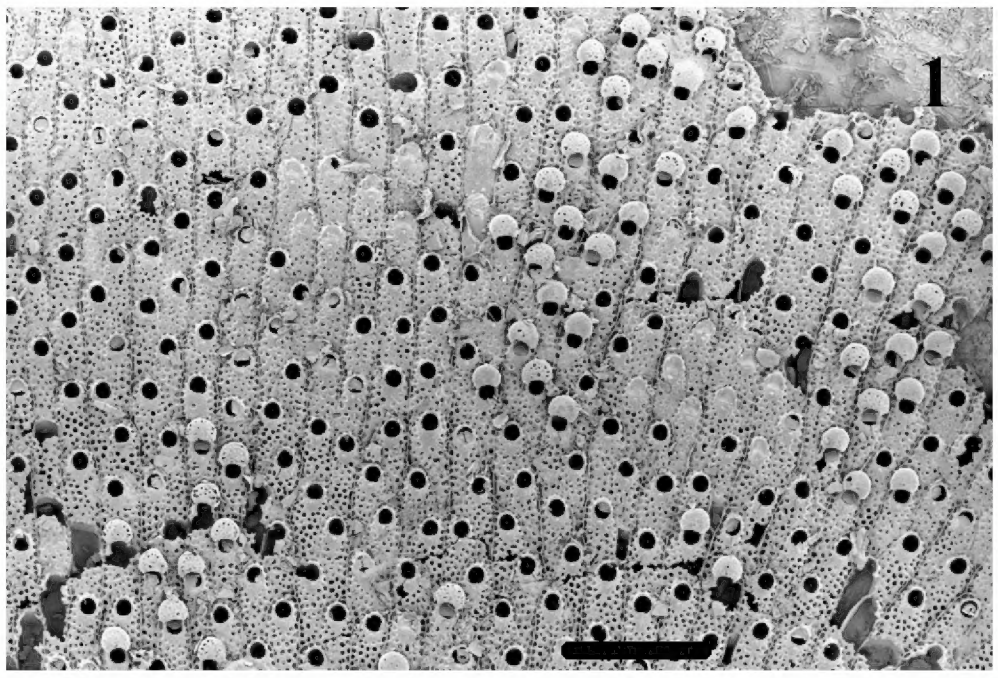

Figure 1. *Hippoporina indica*, colony-wide view. MTQ G25257, Manly Harbour, Brisbane. Scale bar, 1 mm.

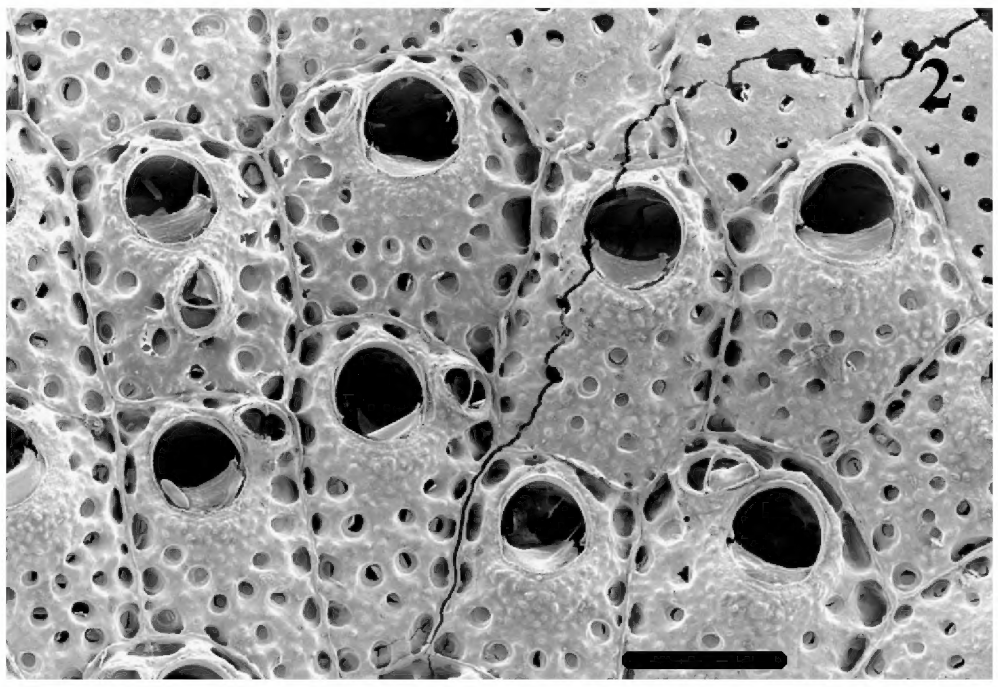

Figure 2. *Hippoporina indica*, group of autozooids. MTQ G25256, Manly Harbour, Brisbane. Scale bar, 200 µm.

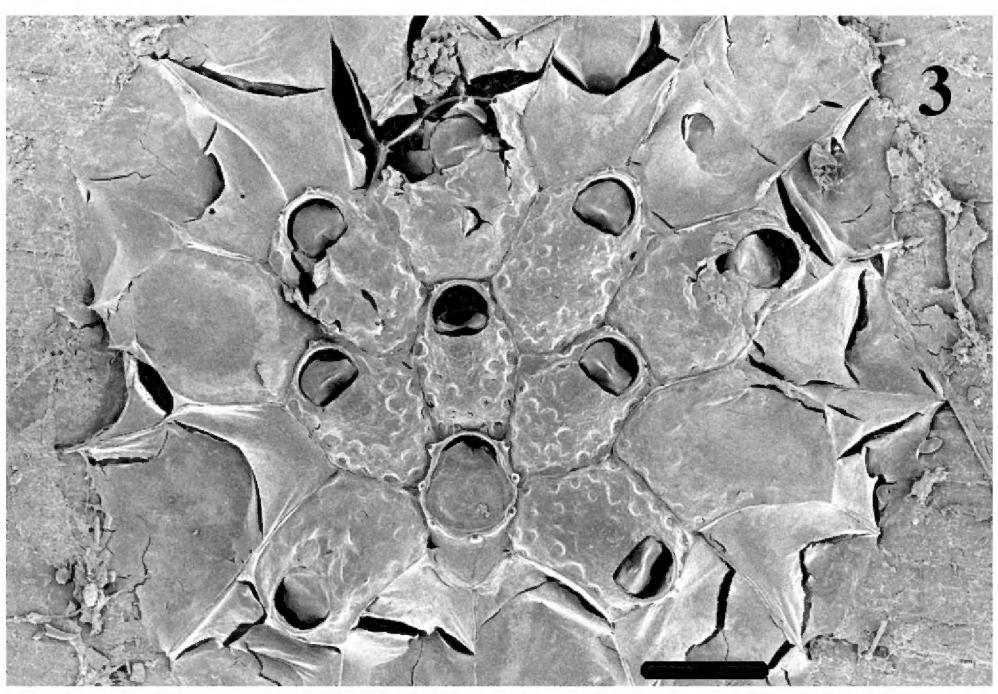

Figure 3. *Hippoporina indica*, colony origin (note the tatiform ancestrula). MTQ G25254, Manly Harbour, Brisbane. Scale bar, 200 µm.

colonies, or portions of larger broken colonies. Needless to say, these basketball-sized colonies were so abundant that on occasion they filled the scallop dredge nets (D. Gordon pers. comm. 2003). It is interesting to note that from its first record in 2003 *B. grandicella* doubled in total amount collected over the next two years but is thought to have been in decline thereafter. This record was the first occasion that *B. grandicella* had been noted outside Chinese waters. However, Gordon *et al.* (2008) noted this species fouling three recreational vessels they surveyed at Opua, Bay of Islands, North Island; two had Tonga as their last port of call after months in the Central Pacific, with the third having Mackay, Queensland as the last port visited after spending well over a year up and down the Queensland coast. Thus, there have already been multiple introductions of *B. grandicella* into New Zealand.

More recently, two small shells encrusted with *Biflustra grandicella* were found amongst beach-cast debris at West Point, Magnetic Island, off Townsville (19°07'54" S; 146°46'51" E) in July 2011. The *B. grandicella* colonies completely covered each shell substrate and were starting to grow outwards in a bilaminar foliate form. Each colony appeared to be actively growing prior to being washed up. A part of a large separate broken colony was also found amongst the beach-cast debris. The material found is identical to that illustrated by Grange and Gordon (2005: figs 4-6) in all respects except that the small cryptocystal denticles seen in the New Zealand material are far less common in the Australian specimens, although this may be an ontogenetic effect. *B. grandicella* may have been introduced to the Queensland coast as far back as 2005 by the vessel that Gordon *et al.* (2008) found fouled by the species that had spent time in Cairns, Bundaberg and Mackay after sailing through Polynesia and Melanesia. The impact of *B. grandicella* locally is yet to be determined but it may be that these records are just the beginning of a consolidation of the species along the Queensland coast.

Neither *Hippoporina indica* nor *Biflustra grandicella* have been recorded previously in surveys or local inventories, i.e. Townsville (Hall 1984), Sydney Harbour

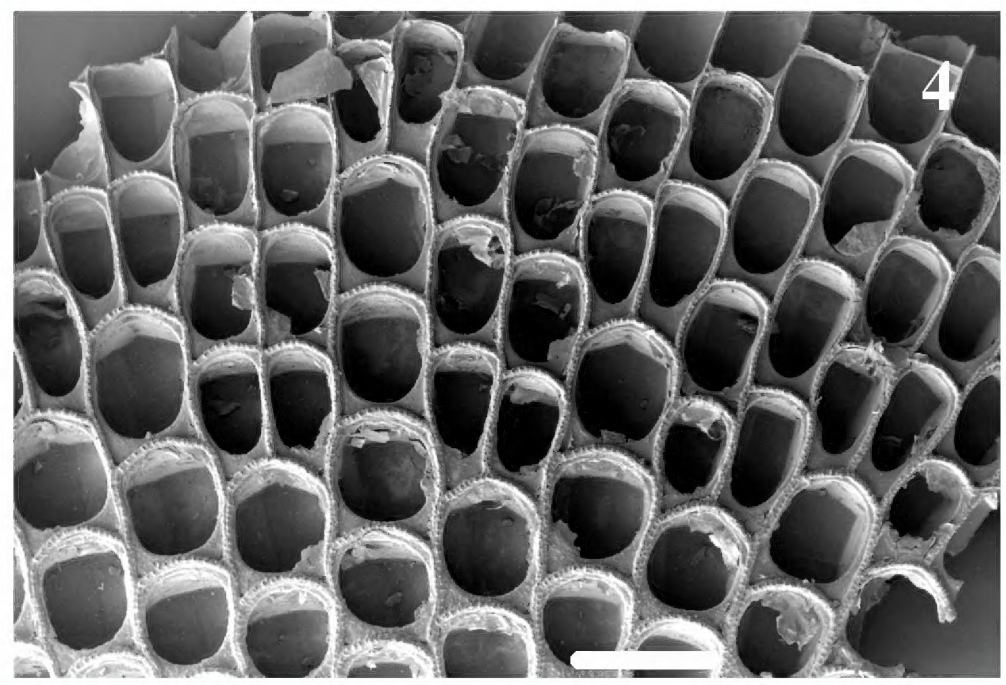

Figure 4. *Biflustra grandicella*, colony view. MTQ G25333, Magnetic Island, Townsville. Scale bar, 500 µm.

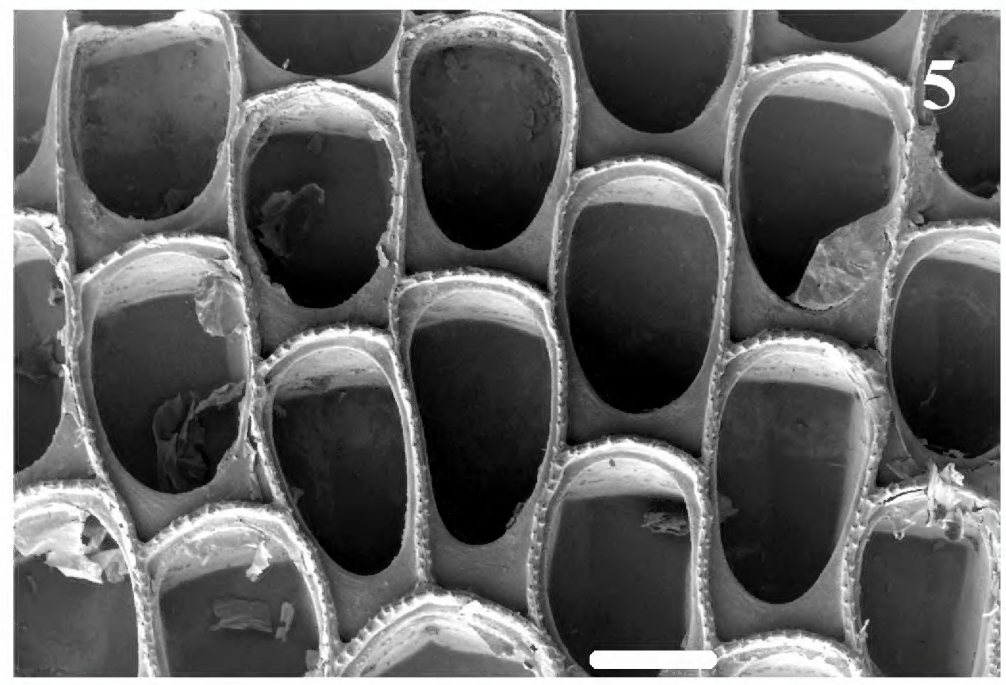

Figure 5. *Biflustra grandicella*, group of autozooids. MTQ G25333, Magnetic Island, Townsville. Scale bar, 200 µm.

(AMBS 2002), Port Phillip Bay (Hewitt *et al*. 2004). Both Brisbane and Townsville marinas generally berth mostly local recreational vessels but some transoceanic craft also dock. This is probably more prevalent in Brisbane than in Townsville; however, in Townsville the TMBYC marina is in relatively close proximity to the international freight docks that could act as the gateway for these introductions in the north. Coutts and Taylor (2004) found that vessels plying trans-Tasman routes possessed greater levels of biofouling than vessels that visited from ports of greater latitudinal distances. Therefore, it is quite possible that *H. indica* and *B. grandicella* were introduced from New Zealand. Bryozoans are some of the commonest constituents of marine biofouling communities and as such are becoming spread on a worldwide scale (Gordon and Mawatari 1992), with Gordon *et al*. (2008) noting 25 newly introduced bryozoan species to New Zealand since 2000.

Finally, the ctenostome bryozoan *Zoobotryon verticillatum* (Delle Chiaje, 1828) (Vesiculariiadae; Ctenostomata) has recently (July 2011) been found in TMBYC marina. This is not a new invasive to Australia as it was recorded back in the 19th century from South Australia (MacGillivray 1889: listed as *Vesicularia bilateralis*). However, it has not been recorded previously from tropical Australia. It was absent from Hall's (1984) Townsville list, and to date this species has been common only in the southern Australian states, particularly South Australia, around Adelaide (Karen Gowlett-Holmes per comm. 2011), Victoria, in Port Philip Bay (Hewitt *et al*. 2004), and New South Wales, including Sydney Harbour (AMBS 2001). Preliminary molecular work on Townsville colonies shows that *Z. verticillatum* from Queensland has the same genetic haplotype as colonies found in Brazil (Karin Hoch Fehlauer-Ale pers. comm. 2011).

The author has recently embarked on a re-survey of the bryozoan fauna of Townsville with settlement panels placed in the TMBYC. In the meantime specimens from TMBYC marina have been sent for genetic analysis as part of a larger project to look at the distribution of genetic haplotypes of several known invasive bryozoan species, i.e. *Bugula neritina* (Linnaeus, 1758), *B. stolonifera* Ryland, 1960, and *Zoobotryon verticillatum*, in an effort to determine the connectivity between populations.

All material illustrated is deposited in the Museum of Tropical Queensland (MTQ).

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